Chisholm

SERVICE MANUAL FOR
GENERAL RADIO SERVICE
MODEL GRS 1566

D.O.T. Approval No.
137361026

C.S.A. Approval No.
LR 19921

Frequencies
Range 27.005 - 27.225
IF 455 Kc

Electrical Ratings
117v AC - .5 amp - 60 cycle
12v DC - 4.5 amp -
6v DC - 10 amp -

NOTICE: RE PARTS ORDERING

In order to assure correct parts shipped please supply the following information:

(1) Chisholm part number of part from Manual
(2) Serial number of set
(3) Model number of set
(4) Date set was purchased, and the colour.

Your parts guarantee will be effective only when the parts warranty registration card is filled out and mailed to the factory within ten days of original purchase.

REGISTRATION CARD

IMPORTANT
Warranty void unless mailed within ten days of original purchase. All information must be filled completely.

Chassis _____ Model No. _____
Serial No. _____ Date of Purchase _____

Gentlemen:
I have purchased the above Chisholm Transceiver on the date indicated.

NAME _____
ADDRESS _____
DEALER'S NAME _____
ADDRESS _____

90 DAY PARTS WARRANTY

NOTE

All general radio service crystals have a different correlation factor. Therefore all crystals used in the GRS 1566 set should be CIL crystals purchased from Chisholm Industries Limited.

TABLE OF CONTENTS

	Page No.
Description, Power Supply and Control Circuits	2
Circuit Description, Receiver	2-3
Circuit Description, Transmitter	3-4
Antenna and Antenna Structure Requirements	4
Installation Procedure	5
How to Assemble Connector (RG58U and RG8/U)	5-6
Internal Adjustments	6
Tuneup on other Channels	6
Conversion of 12VDC to 6VDC	7
Operating Procedure	7
Service Tuneup	8
Parts Locations and Diagram	9
Suppression (Engine Noise)	10-11-12-13-14
Parts List	15-16
Schematics	17

Part No: 74072

Printed in Canada

CHISHOLM INDUSTRIES LIMITED

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

DESCRIPTION, POWER SUPPLY AND CONTROL CIRCUITS:

Power input can be 117 volts AC; 12 volts DC; or, with a minor circuit modification, 6 volts DC. For 117 volt AC operation, the AC cable is connected to the power receptacle; for 6- or 12-volt DC operation, the DC cable is plugged into the power receptacle. When operating on 117 volts AC, the line voltage is stepped up by one winding of transformer T-2 and converted to DC. Another winding of T-2 steps-down the 117 volts to a value suitable for use by the heaters of all tubes. When operating with 6 or 12 volts DC, the DC cable automatically switches the unit to DC operation and the appropriate voltage is applied to the heaters of all tubes. Vibrator VIB-1 converts the steady-state DC to a pulsating DC. The pulsating DC is applied to a winding on transformer T-2; and the stepped-up voltage appearing at the secondary winding of T-2 is converted to DC by the rectifiers CR-2 and CR-3 and capacitors C-69 and C-70 forming a voltage doubler circuit. Resistors R-55, R-56 and capacitors C-71, C-72 filter the varying DC output of the voltage doubler. The DC output is applied directly to the audio driver and output stages V-3 and V-4, and via resistor R-16 to the coil of the keying relay, K-1. The coil of the keying relay is actuated by grounding the low end through the push-to-talk switch on the microphone. When receiving, the microphone switch is up, permitting the relay contacts to energize the receiver as follows: K-1A connects the antenna to the receiver, K-1C applies DC to all stages of the receiver and K-1B grounds the speaker to place it in operation. The audio driver and the output stages are supplied with DC continuously, since they are used for both transmitting and receiving. When the microphone push-to-talk switch is pressed, K-1 closes and its contacts place the transmitter on the air as follows: K-1A transfers the antenna to the transmitter output, K-1C applies DC to the transmitter oscillator (V-1A), K-1B grounds the cathodes of both the oscillator and power amplifier and K-1D applies modulated DC to the power amplifier, to place the transmitter carrier on the air.

CIRCUIT DESCRIPTION, RECEIVER:

The receiver is a XTAL controlled superheterodyne with squelch, automatic noise limiting, and noise-controlled AVC circuits, all included to give superior reception properties. The incoming signal is amplified by V-7, the RF amplifier, and applied to the mixer grid (V-8A). A signal 455 kc higher than the channel frequency is coupled to the grid from oscillator section V-8B, an independent triode in the same envelope. The oscillator is a Colpitts circuit, with frequency doubling in the plate circuit. The mixer grid is AVC controlled through V-5B, the mixer AVC gate diode. This diode conducts for AVC voltage, but prevents the oscillator injection voltage from feeding back into the AVC line. The IF is amplified by two IF stages, V-9 and V-10, which differ only in that the gain of V-9 is AVC controlled, and the gain of V-10 is fixed by the cathode resistor R-46. The detector, V-6B, supplies audio to the audio driver V-3A through a series-gate noise-limiter circuit. This consists of the gating diode V-6A, capacitors C-32 and C-34, and resistors R-22.1, R-22.2, R-25 and R-26. Due to the RC time constants, V-6A is biased to conduct (and pass audio signals) for normal voice signals, but stops conducting for high-amplitude noise pulses of short duration. The second detector also supplies AVC voltage, a noise controlling voltage to modify the AVC voltage, and squelch voltage. The AVC system consists of R-49 and C-39.1, an RC filter, with carrier signal taken from

CIRCUIT DESCRIPTION, RECEIVER (Continued)

the secondary of L-12. Another RC filter from this point (C-36 - R-27) responds to short-duration noise pulses only; these are passed through C-35 to drive the noise amplifier V1-B. The amplified noise is then rectified by V-5A and applied as a positive bias to the AVC line. This arrangement keeps the receiver gain high in the presence of noise, thus making it possible to receive weak signals through noise. Without this arrangement, such weak signals would otherwise be lost. The squelch system biases off the audio driver stage V-3A whenever the received carrier amplitude is less than a given value, as determined by the setting of the squelch control R-50. The squelch rectifier tube V-6C rectifies the carrier to develop a negative voltage which opposes the positive voltage from the squelch control R-50. For normal reception, the total voltage is negative to ground by an amount great enough to keep the squelch control tube V-3B from conducting. The audio driver tube V-3A now acts as a regular class A, RC coupled amplifier, with bias due to contact potential current through R-13. When the receiver signal is removed, or the level drops below the value selected for squelching, the bias for V-3B goes more positive, and V-3B conducts. The plate current of V-3B flows through R-14 and R-33 to B+; the resulting voltage drop across R-14 biases V-3A beyond cut-off, and the audio is removed (squelched). The noise amplifier-rectifier system (V-1B - V-5A) adds a positive bias to the grid of V-3B (through resistor R-23) during squelched conditions, causing the squelch to hold steadily under noisy conditions. The audio output stage is a class A audio power amplifier with transformer coupling to the 3.2-ohm speaker. For receiving, the signal level meter is connected to a bridge circuit. One side of the bridge consists of R-8, R-9 and R-10. The other side consists of resistors R-44 - R-45 to B+ and the effective cathode-to-screen resistance of V-9 and R-43 to ground. The METER ZERO control R-9 is set to zero reading with no signal; with signal, the effective cathode-screen resistance changes directly as the AVC voltage varies. This unbalances the bridge to give a reading which varies approximately as the signal varies.

CIRCUIT DESCRIPTION, TRANSMITTER:

The transmitter is a master oscillator-power amplifier circuit with crystal control of the operating frequency. The oscillator stage uses one triode section of a 12AV7 in a Colpitts circuit. The oscillator plate tank (L-2 - C-4) is tuned to the channel frequency, while the grid circuit operates at one-half the channel frequency. The RF developed across the plate tank drives the grid of the power amplifier tube (V-2) a type 6AQ5. The plate of V-2 is tuned to the channel frequency by a pi-section network consisting of L-4, antenna loading capacitor C-14, and the power tuning capacitor C-11. The power amplifier operates class C, with grid bridge neutralization (Rice system). Capacitor C-12 is the neutralizing capacitor. L-5 and C-17, together with a portion of the loading capacitance (C-14) act as a second pi-network which is fixed-tuned to reduce possible radiation of harmonic frequencies above the highest channel. The output from the second filter is fed to the antenna through one set of contacts of the antenna transfer relay K-1A. The meter rectifier (CR 1) rectifies a small portion of the RF voltage developed across the output loading capacitor, and the signal level meter reads the rectified voltage. The modulating signal for the transmitter is obtained through V-3A and V-4. These stages serve as the audio driver and the modulator stages, respectively, while transmitting.

CIRCUIT DESCRIPTION, TRANSMITTER (Continued)

The audio from the microphone is fed through the "cold" end of the volume control, amplified by V-3A, a class A resistance-coupled audio voltage amplifier, and again by V-4, a class A audio power amplifier. The speaker is disconnected while transmitting, due to K-1B. The primary of T-1 acts as a choke across which the audio modulating voltage is developed. This in turn modulates the plate and screen voltage of the RF power amplifier stage in what is commonly referred to as a "choke coupled" or "Heising" modulation system.

ANTENNA:

The GRS 1566 Radiophone is designed and tuned for operation into a 52 ohm antenna. The following information is reprinted from Radio Standards Specification 136, Issue 1.

ANTENNA STRUCTURE REQUIREMENTS FOR LAND STATIONS IN THE GENERAL RADIO SERVICE

Where a land station antenna structure is to be erected, such structure shall be subject to prior Department of Transport approval on the following basis:

(a) When within three miles of the centre of either a land or water aerodrome, Department of Transport form 2022A shall be completed by the applicant.

(b) When between three and six miles from the centre of either a land or water aerodrome:

  (i) Where the antenna is to be erected on an existing structure and will not exceed 20 feet in height above that structure, completion of 2022A forms will not be required.

  (ii) Where the antenna structure is to be self-supporting, completion of 2022A forms by the applicant will be required; however, where such antenna structure will not exceed 75 feet in height above ground level and will not exceed 20 feet in height above any terrain features or existing structures within a radius of 1,000 feet, forms 2022A will not be required.

(c) Beyond six miles from the centre of a land or water aerodrome:

  (i) Where the antenna is to be erected on an existing structure and will not exceed 30 feet in height above that structure, 2022A forms will not be required.

  (ii) Where the antenna structure is to be self-supporting, completion of 2022A forms by the applicant will be required; except where such antenna structure will not exceed 75 feet in height above ground level and will not exceed 30 feet in height above any terrain features or existing structure within a radius of 1,000 feet, forms 2022A will not be required.

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

INSTALLATION PROCEDURE

When the crystals are installed, the unit is pre-tuned and ready to operate when ground, antenna, and power connections are made.

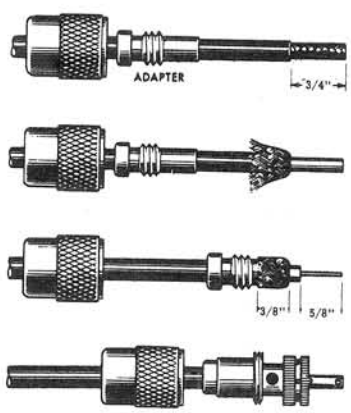
BASE STATION

(1) Connect ground terminal to water pipe or other good ground.
(2) Install antenna according to instructions furnished. In general, the antenna should be located in the clear and as high as possible.
(3) Plug in antenna and AC power cord; the set is now ready for operation.

VEHICULAR INSTALLATION

(1) Install mounting hood under the dash or other convenient location. (Note that DC primary cable supplied with the set may have to be lengthened if the unit is mounted elsewhere.)
(2) Connect the ground side of the DC primary cable to a cleaned metal spot on vehicle chassis. Bolt securely.
(3) Connect hot side of primary cable (wire with in-line fuse) to ignition switch or accessory binding post in vehicle. For normal installation, this should be a post which is switched on and off by the ignition key.
(4) Install antenna according to instructions furnished.
(5) Install set on mounting hood and tighten in place. Insert antenna and power-cord plugs; the set is now ready for operation. With the radiophone in operation, start up the vehicle engine and listen for ignition noise. Excessive ignition noise will seriously impair weak signal reception. (Refer to Ignition Suppression Section.)

HOW TO ASSEMBLE ANTENNA CONNECTOR to coaxial RG58/U lead-in cable:



Cut end of cable even. Remove vinyl jacket 3/4". Slide coupling ring (part of 83-1SP) adapter (83-185) on cable.

Fan braid slightly and fold back as shown.

Position adapter to dimension shown. Press braid down over body of adapter and trim to 3/8". Bare 5/8" of conductor. Tin exposed centre conductor.

Screw plug sub-assembly (part of 83-1SP) on adapter. Solder braid to shell through solder holes. Use enough heat to create bond of braid to shell. Solder conductor to contact.

For final assembly, screw coupling ring on plug sub-assembly.

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

HOW TO ASSEMBLE ANTENNA CONNECTOR to coaxial RG8/U lead-in cable:

1. Cut end of cable even.
2. Remove vinyl jacket 1".
3. Remove 13/16" of metallic shield.
4. Bare 3/4" of conductor.
5. After stripping, disassemble connector plug and slide coupling ring (a) over cable.
6. Thread cable into connector shell at (b) (threaded inner wall of connector shell grips into cable providing extra strain relief). Cable should be seated on connector shell so that shielding meets vertical inner wall of connector at (d). Conductor should extend to end of pin contact at (f). Small tooth (e) seats in slot edge of Coax Receptacle.
7. Solder connector shell to shielding through holes provided at (c). Fill pin contact with solder.
8. Bring back coupling ring (a) over connector shell and screw on for full length of coupling ring inner thread.

INTERNAL ADJUSTMENTS

When crystals are installed at the factory, the equipment is tuned so that the station licensee may perform installation and initial tuneup without technical supervision. When so installed, the set will perform satisfactorily without further adjustments. However, it is strongly recommended that a qualified service technician be called in to check the installation. This will ensure optimum performance of the equipment. At the same time, the set can be activated on other General Radio Service channels, as described in the paragraph following, providing always that only crystals supplied by Chisholm Industries Limited (CIL) are used.

TUNEUP ON OTHER CHANNELS

The General Radio Service is divided into 19 channels, as follows:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
4	27.005	9	27.065	14	27.125	19	27.185
5	27.015	10	27.075	15	27.135	20	27.205
6	27.025	11	27.085	16	27.155	21	27.215
7	27.035	12	27.105	17	27.165	22	27.225
8	27.055	13 Emg	27.115	18	27.175		

When one set of crystals is installed at the factory, operation will occur with the channel selector switch in the position marked "A". Additional pairs of crystals, if ordered, are installed in the "B", "C", "D" and "E" positions. The set will operate only on the channel or channels for which crystals are supplied.

Only a qualified service technician should be permitted to set up additional channels or to change channels. When he installs the crystals, he will check transmit frequency and loading, and make appropriate internal adjustments as required.

CHISHOLM GRS CHANNEL IDENTIFICATION TRANSFER

(1) Select the applicable GRS channel number on the sheet.
Cut allowing a border around the individual decal for each heading.
(2) Dip decal in water for a few seconds.
(3) Slide from backing and into position.
(4) Remove air bubbles with soft rubber squeegee. Allow to dry.

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

CONVERSION of 12VDC 117AC to 6VDC 117AC

Step (1) Disconnect green wire at pin 7 of P1 and connect to Point "A". Connect yellow wire taken from Point "A" to Pin 7 of P1.

Step (2) Disconnect blue wire at Pin 10 P1 or feedthru (C63) and connect to Point "B". Connect red/yellow wire taken from Point "B" to Pin 10 P1.

Step (3) Disconnect black wire at Pin 5 of V1 (Point "C")(Note: black wire is on Pin 5 of P1) and connect to Pin 9 of V1 (Point "D"). Ground Pin 5 of V1 (Point "C") by connecting jumper wire to center shield of socket.

Step (4) Remove shield on VIB socket use jumper wire (#16G) to connect Pin 2 to Pin 4.

Step (5) Remove 12V DC marking at rear of chassis mark at 6V DC Point.

OPERATING PROCEDURE

To place the set in operation, rotate the volume control in a clockwise direction, and set the channel switch in position A (or other channel known to be ready for operation). After the set warms up, (about 30 seconds) rotate the squelch control in a counter-clockwise direction and the volume control in a clockwise direction until noise or signals are heard. Set the squelch control as follows: rotate control in a clockwise direction while there are no signals on the air, until the noise stops. Rotate control slightly beyond the point where the noise drops out, at this point any signals, even weak ones, will cause the sound to come back on again. (Note: Very weak signals can best be received by adjusting the squelch control in a more counter-clockwise direction). Key transmitter by pressing microphone button. Turn the power tuning control to the point where the meter reads maximum (for most sets, this will be between 4 and 6 on the scale). Give call sign and observe all other operating procedures which are required by the Department of Transport. Follow the same procedure when selecting another channel - that is, the squelch, volume and power tuning controls may have to be reset after switching from one channel to another.

NOTICE TO GENERAL RADIO SERVICE BAND LICENSEES

Your attention is drawn to the fact that the FULL call sign of the station must be used when calling and on sign-off. The call sign is shown at the top right hand corner of the licence and consists of the letters "XM" followed by a number. The letters "XM" are part of the call sign and must be transmitted as such.

Each exchange of communications between licensed stations shall not exceed five consecutive minutes' duration and upon the termination of an exchange of communications no further transmission shall be made until the lapse of two minutes or until interference will not be caused to other stations using the same frequency.

SERVICE TUNEUP - Model GRS 1566

The unit comes factory tuned to one of the channels near the middle of the band (see paragraph on internal adjustments). Re-tuning on specific operating frequencies may improve performance in some cases, particularly if the channels used are at one end on the band.

The transmitter tuneup procedure is as follows:

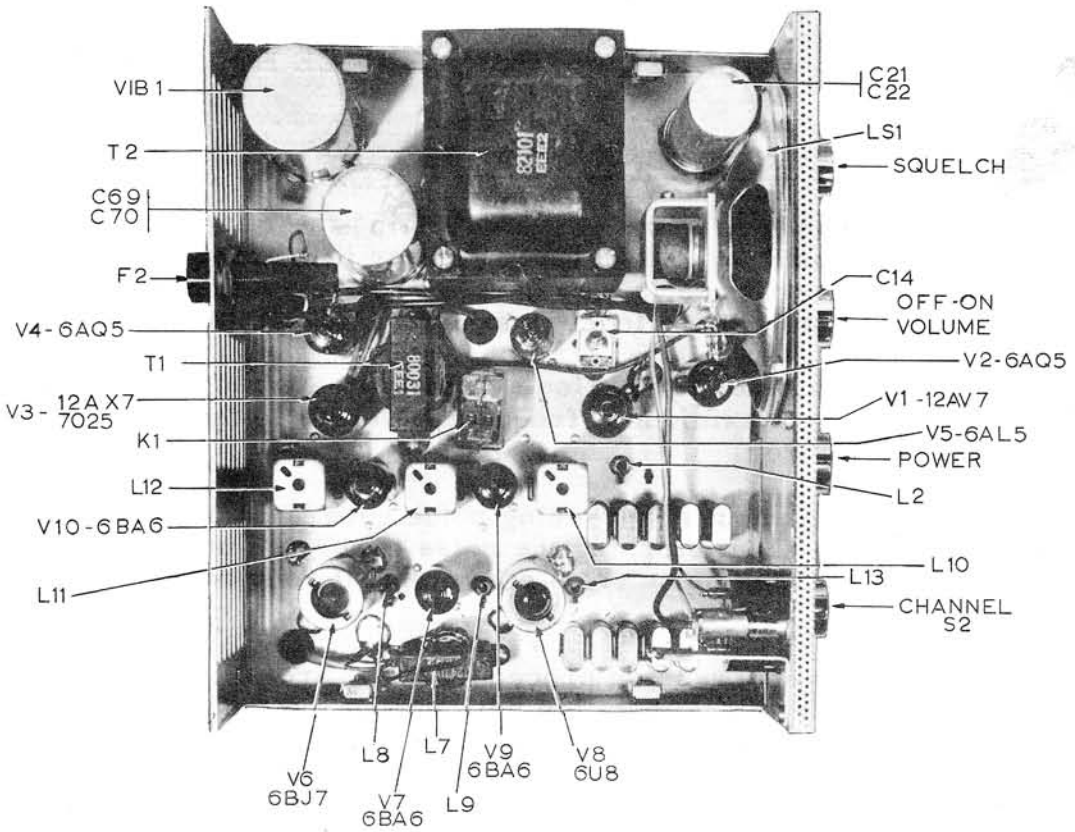
1. Tune L2 for maximum output.
2. Adjust power tuning control for maximum meter reading.
3. Plate voltage of V2 (typical 210 v) should be measured by placing service voltmeter between J1 (black pin jack) located on chassis backplate and chassis ground.

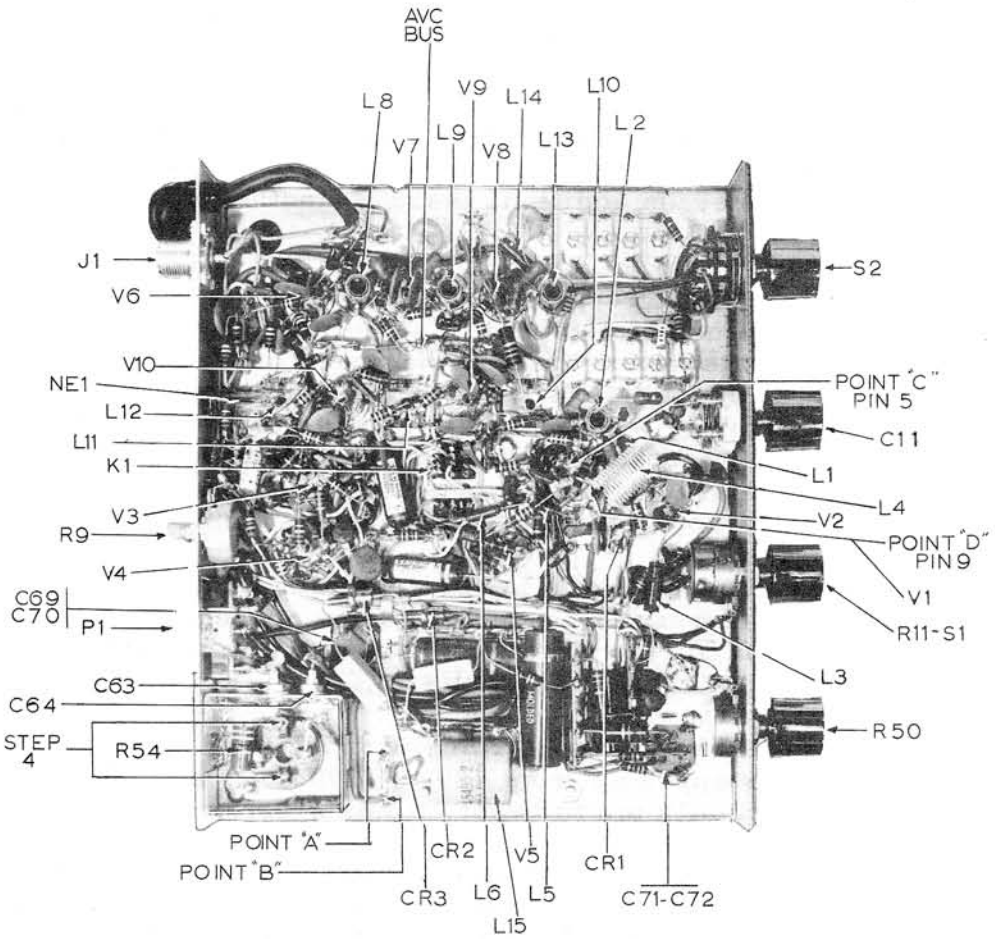
Then, check plate current of V2 by placing the service voltmeter across J1 and J2, reading the voltage drop (typical 2.4 v) through R6 (100 ohms). Calculate the plate-current flow through R4. The plate power input to the final amplifier can then be calculated (P=E1). If plate power input is 5 watts no further internal adjustments are needed in the transmitter section. If power input must be changed, reset C14 by rotating clockwise or counter clockwise by a small amount, and then repeat steps (1), (2), and (3). If power input is still not correct, reset C14 again and repeat these steps until the correct reading is obtained. (2.4 v for 5 watt input.)

For receiver tuneup, a simple peaking adjustment of the antenna and RF tuned circuits will usually be all that is necessary. To do this, use the signal level meter and tune L9 and L8 for maximum while receiving a weak signal. The receiver IF transformer should be left alone unless there is definite evidence that the tuning is required. If this is the case, apply a 455 kc crystal controlled $\pm$ .001% signal to the mixer grid and tune L10, L11 and L12 for maximum meter reading, as in conventional receiver-alignment techniques. The frequency should be exactly 455 kc to avoid possible loss of some stations which may be operating near the limits of channel frequency tolerance. Local broadcast stations can be used to establish check points to confirm signal-generator calibration at 455 kc.

PARTS LOCATIONS

The following is a bottom and top view photograph of the GRS 1566. The location of individual circuit components is clearly illustrated. To locate a part, refer first to the schematic diagram; if the part in question is connected directly to a tube-socket terminal, it may not be identified on the photograph. A detailed description of each part is listed at the end of this manual.


VIB 1
T2
C69
C70
F2
V4 - 6AQ5
T1
V3 - 12AX7
7025
K1
L12
V10 - 6BA6
L11
C21
C22
LS1
SQUELCH
C14
OFF-ON
VOLUME
V2 - 6AQ5
V1 - 12AV7
V5 - 6AL5
POWER
L2
L10
L13
CHANNEL
S2
V6
6BJ7
L8
V7
6BA6
L7
L9
V9
6BA6
V8
6U8


AVC
BUS
L8
V7
V9
L9
L14
V8
L10
L13
L2
J1
V6
S2
V10
NE1
L12
L11
K1
V3
R9
V4
C69
C70
P1
C63
C64
STEP
4
R54
POINT "A"
POINT "B"
CR2
CR3
V5
L6
L5
L15
CR1
C71-C72
POINT "C"
PIN 5
C11
L1
L4
V2
POINT "D"
PIN 9
V1
R11-S1
L3
R50

SUPPRESSION - REDUCING IGNITION NOISE

Ignition noise is one of the prime factors limiting the range of GRS mobile installations. The range would be considerably greater if the full sensitivity of receivers could be utilized but what use is it to have a receiver with one-microvolt or better sensitivity if the ignition noise level is several microvolts?

Unfortunately, the automobile ignition systems create and radiate radio-frequency energy whose level is maximum at frequencies close to the 27-mc. band. This is bad for the GRS operator.

You can do something about suppressing noise generated by your own car, but there is nothing you can do about stopping the noise generated by other cars. You will, however, experience less noise from other cars if your receiver incorporates a noise limiter.

Sometimes the noise-suppression procedures that are followed when a standard AM broadcast-band auto radio is installed will suffice - but not always. It is common to install spark-plug suppressors in all of the plugs and a suppressor in the distributor rotor ignition coil lead in order to reduce ignition noise. Also, a filter capacitor is usually installed across the armature terminal of the car's generator to reduce generator-produced noise. If these measures do not stop the noise, coax or conventional capacitors are also installed at the hot (battery) primary lead of the ignition coil, the ammeter, dome light, and dashboard instruments to bypass to ground the ignition noise signals picked up and re-radiated by the vehicle's low-voltage wiring.

Ignition noise exists because each of the spark plugs in the engine is small, but potent, "spark transmitters" - which are still fondly remembered by old-time hams and ship radio operators. In addition, there is another spark transmitter under the distributor cap.

A very high-potential pulse, ranging from 10,000 volts to 20,000 volts, is generated every time the distributor points open. The points, shown in Fig. 1, are opened and closed by a cam at a rate determined by the speed of the engine. When the points close, DC flows from the vehicle's battery through the ignition switch, S1, distributor points, and the primary winding of the ignition coil - setting up an intense magnetic field which envelopes the ignition-coil secondary. When the points open, the DC flow in the primary winding ceases abruptly, causing the magnetic field to collapse and inducing a potential in the secondary winding of the ignition coil.

The e.m.f. induced in each turn is in series-aiding with the e.m.f. in the other turns. The high voltage results not only because of the very high turns ratio of the windings in the ignition coil but because of the sharp magnetic kick caused by sudden cessation of current flow through the primary.

The ignition-coil turns ratio ranges from 40:1 to 100:1. As a straight transformer, the 12 volts would be stepped up from 480 to 1200 volts but because of the inductive

SUPPRESSION (Continued)

Each of these gaps looks like a very high impedance until the dielectric (air or vapor) breaks down and an arc is formed across the gap. Then, each gap looks like a low impedance and, for the very short duration of the spark, the current flow is large and a magnetic field is developed around the ignition wires. Thus we have a spark transmitter whose resonant frequency is determined by the inductance and capacitance of the ignition circuitry.

SUPPRESSORS

A high voltage is required to cause a spark to jump across a gap; the current can be infinitesimal. For this reason, we can reduce the current to reduce the noise-radiating field, without reducing the effective voltage. Even if a 1-meg-ohm resistor (R1) is connected in series with the spark gap, as shown in Fig. 3A, the source voltage, E1, will be equal to E3, the voltage across the gap. There will be no voltage (E2) across R1 because there is no current flow before the gap breaks down and is arced across.

But, this ideal gap condition does not exist. As shown in Fig. 3B, there may be leakage resistance across the gap (dirty spark plugs). This leakage resistance, R2, is in series with R1, and the voltage applied to the spark gap, E3, is equal to the voltage E1, minus E2.

It is for this reason that the distributor suppressor is usually a 7500-10,000-ohm resistor and each spark plug suppressor has a resistance of about 5000 ohms. The total 15,000-ohm resistance in series with the two gaps (distributor and one spark plug) has negligible effect, except when spark plugs are badly fouled.

It is the general consensus that the use of spark plug and distributor suppressors does not interfere with engine performance nor increase fuel consumption.

To reduce the direct radiation of ignition interference, suppressors can be installed on each spark plug and at the distributor. These suppressors consist of a resistor encased in a tubular insulating housing with terminals on each end to fit the spark plugs or distributor to the ignition cables. Instead of suppressors, spark plugs which have built-in resistors can be substituted or, alternatively, special ignition cables with built-in resistance (provided in many new cars) can be used. Series resistance in the ignition circuits has two effects. It reduces the radiated field by limiting current and broadens the resonance (lowers the "Q") of the wiring.

ADDITIONAL REMEDIES

In addition to the high-voltage ignition system, electrical noise is caused by the vibrating contacts within the current-voltage regulator, the brushes and commutator of the generator, the opening and closing of the distributor points, and the charging and discharging of the distributor capacitor (C1 in Fig. 1).

For an ordinary auto radio, generator "whine" is adequately suppressed by installation of a 0.1 to 0.25-mf. 100 v capacitor between the frame of the generator and the output terminal of the generator which is connected internally to a brush that contacts the armature. In Fig. 2, this capacitor is shown as C1.

ADDITIONAL REMEDIES (Continued)

However, for GRS reception, this may not be adequate. A parallel-resonant wave-trap (L1 and C5) may be connected in series with the generator output lead, as shown in Fig. 2.

With the engine running and the receiver on (unsquelched), C5 is adjusted for the minimum generator whine. When tuned correctly, L1-C5 serve as a very high impedance at the GRS operating frequency. The trap is used in conjunction with C1 to cut out generator whine when using the regular auto radio.

The noise caused by the vibrating contacts of relays RL1, RL2 and RL3 (Fig. 2) of the regulator may be minimized by connecting a 0.1- to 0.25-mf. 100 v capacitor (C3) between the grounded cover of the regulator and its battery terminal and another capacitor (C4) between the cover and the generator terminal of the regulator.

Filters are usually not connected to the field terminal of the generator or regulator because of possible damage to the regulator relay contacts. But a circuit that is sometimes recommended for connection here is a resistor (R3) with a value of 3.9 to 6.8 ohms and a series mica or ceramic capacitor (C6) of around 200mmf., as shown in Fig. 2, between the regulator cover and its field terminal.

FILTER CAPACITORS

Ordinarily, capacitors used for noise suppression are paper types enclosed in a metal cylinder. The protruding wire is for connection to the "hot" side of a circuit and the mounting lug of the capacitor enclosure is fastened to the generator or the regulator cover, firewall, or other grounded surface. To be effective, the lug must make firm contact with clean metal (paint or grease removed) or to the mounting bolt. Suppressor capacitors with two leads (one to ground) do not have to be mounted rigidly.

Although these standard auto-radio noise suppressors are adequate for AM broadcast-band reception, they may not be adequate for GRS reception. This is due to the fact that standard paper capacitors possess inductance as well as capacitance. This inductance has no significant effect at relatively low frequencies, but may be so great at 27mc. as to offset the bypassing effect of the capacitor. Sufficient bypassing at both broadcast-band frequencies and at 27 mc. can often be achieved by shunting ordinary capacitor suppressors with a 0.001-mf. ceramic unit, which has very low inductance.

An even better arrangement is to use coaxial capacitors. Instead of conventional suppressor capacitors (C2 of Fig. 1 and C3 and C4 in Fig. 2), coaxial types may be substituted. A coaxial capacitor is a feedthrough type. The lead to the "hot" primary terminal of the ignition coil, for example, is removed and connected to one end of the capacitor. The other end is connected to the ignition coil. The current flows through the capacitor from "A" to "B" via a conductor which is

BONDING AND SHIELDING

If all of these measures do not reduce noise adequately, try bonding the hood to the firewall and the tail pipe to the car's frame, using one-half inch wide tinned copper braid.

It may also be necessary to shield the leads between the regulator and the generator, grounding the shield to the generator frame. Or, existing wires may be replaced by shielded cable with inner conductors of adequate size and insulation for the voltage to be carried.

Tire static may be eliminated by blowing static powder (G-C and other brands) into the tires, using the injector provided with the kit. Wheel noise can be eliminated by installing springs under the hub caps to ground the axle to the wheel. Such springs are available at radio parts jobbers.

If all these measures fail to reduce noise to a sufficiently low level, a shielded ignition system can be installed. Available in kit form from Hallett and others, the system includes shielded cables to replace all the ignition wiring plus shields for the ignition coil, distributor, the spark plugs, and the regulator. A kit for a typical car is available from those of the larger electronic parts dealers who have industrial departments. Such shielded systems are widely used in military and public-safety vehicles.

To determine if your car needs noise suppression, or to determine if the elimination methods have been effective, turn on the GRS set (unsquelched) and listen to the noise with the engine on and the car moving. Then stop the car and turn off the engine and note the difference in background noise level. The most effective test is run when receiving a very weak radio signal.

Although effective noise suppression may take some time and trouble, the results are worth the effort.

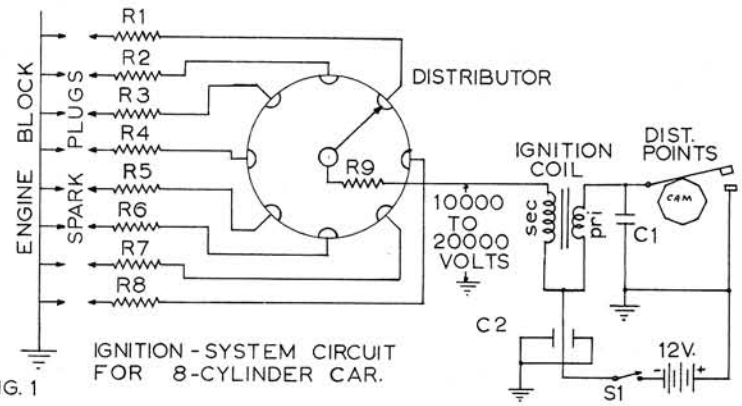


FIG. 1 IGNITION-SYSTEM CIRCUIT FOR 8-CYLINDER CAR.

C1 - .1 - .25 mf 100v condensor
C2 - Part of Distributor in car
R1 - R-8 - Resistor type plugs or wire.
R9 - Suppressor or radio resistor wire.
S1 - Ignition switch

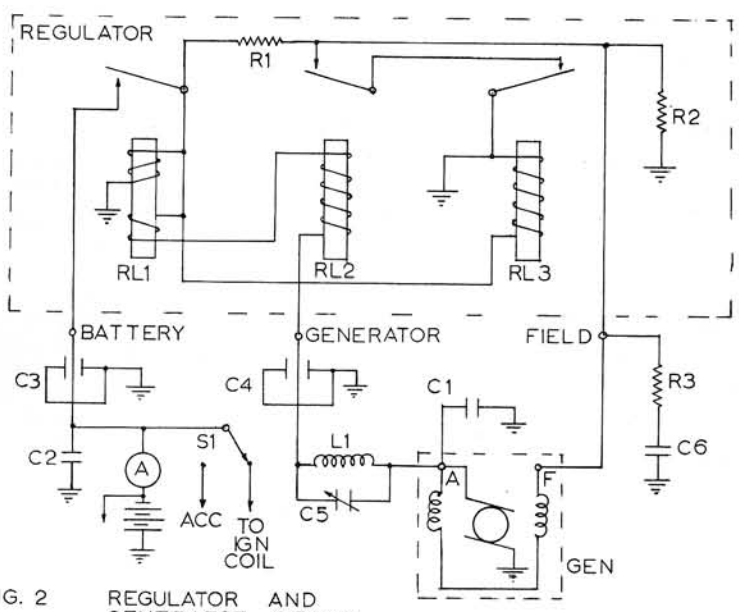


FIG. 2 REGULATOR AND GENERATOR CIRCUIT.

C1 - .1 - .25 mfd 100v condensor.
C2 - Same as C1
C3 - .1 - .25 mfd 100v coax condensor
C4 - Same as C3
C5 - 3 - 35 mmf compression trimer condensor.
C6 - Ceramic 200 mmf 400 v condensor.
R3 - 3.9 - 6.8 ohm 1/2 watt 20%
L1 - 8 terns of #10 enameled wire wound on a 1" diameter form.

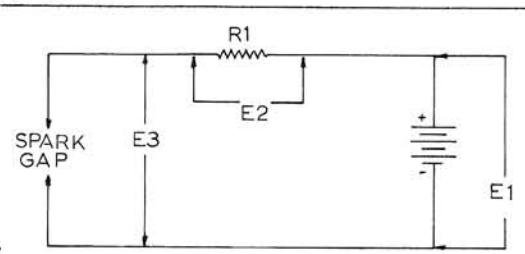


FIG. 3A

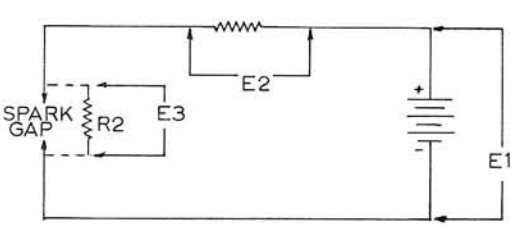


FIG. 3B

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

REPLACEABLE PARTS

REF. SYMBOL	DESCRIPTION	PART NO.
	CAPACITORS	
C-1	Ceramic 10 mmf, 500v, N330 ± 5%	15130
C-2	Ceramic 15 mmf, 500v, N080 ± 5%	15132
C-3	Mica 100 mmf, 500v, ± 5%	15417
C-4	Ceramic 15 mmf, 500v, N080 ± 5%	15132
C-5	Same as C-3	15417
C-6	Mica 33 mmf, 500v ± 5%	15416
C-7	Ceramic .002 mf, 100v ± 10%	15176
C-8	Ceramic .01 mf, 500v Z5U +80% -20%	15137
C-9	Same as C-7	15176
C-10	Same as C-7	15176
C-11	Air variable 3-14.2 mmf	18112
C-12	Ceramic 5.6 mmf 500v, N080 ± 5%	15134
C-13	Same as C-12	15134
C-14	Mica Trimmer 110-580 mmf	18113
C-15	Ceramic 2.2 mmf 500v N080 ± 5%	15135
C-16	Mica 22 mmf, 500v ± 5%	15422
C-17	Same as C-3	15417
C-18	Same as C-22	15419
C-19	Same as C-8	15137
C-20	Same as C-7	15176
C-21	Same as C-7	15176
C-22	Mica 47 mmf 500v ± 5%	15419
C-23	Same as C-8	15137
C-24	Same as C-8	15137
C-25	Electrolytic 5 mf 50 v	15201
C-26	Same as C-27	15109
C-27	Ceramic .001 mf 500v, Z5U ± 10%	15109
C-28	Not used	
C-29	Electrolytic 50 mf 25v	15216
C-30	Ceramic .005 mmf 1KV + 100%-0%	15177
C-31	Same as C-8	15137
C-32	Ceramic .05 mf 100v +80% -20%	15140
C-33	Mica 200 mmf 500v ± 5%	15420
C-34	Same as C-3	15417
C-35	Same as C-3	15417
C-36	Same as C-33	15420
C-37	Molded mylar .1 mf 200v ± 20%	15673
C-38	Ceramic 22 mmf 500v, N080 ± 5%	15161
C-39	Same as C-6	15416
C-39.1	Same as C-37	15673
C-39.2	Same as C-8	15137
C-40	Same as C-8	15137
C-41	Same as C-8	15137
C-42	Same as C-2	15132
C-43	Mica 68 mmf 500v ± 5%	15421
C-44	Same as C-8	15137
C-45	Not used	
C-46	Same as C-8	15137
C-47	Same as C-8	15137
C-48	Same as C-8	15137
C-49	Same as C-8	15137
C-50	Same as C-8	15137
C-51	Same as C-8	15137
C-52	Same as C-8	15137
C-53	Same as C-8	15137
C-54	Same as C-8	15137
C-55	Same as C-3	15417
C-56	Ceramic 4.7 mmf, 500v N080 ± 5%	15131
C-57	Same as C-8	15137
C-58	Same as C-38	15161
C-59	Same as C-8	15137
C-60	Same as C-2	15132
C-61	Mica 150 mmf 500v, ± 5%	15418
C-62	Same as C-8	15137
C-63	Same as C-64	15136
C-64	Ceramic .001 mf 500v ± 10%	15136
C-65	Same as C-8	15137
C-66	Molded mylar .47 mf 200v ± 10%	15675
C-67	Same as C-32	15140
C-68	Molded mylar .12 mf 600v ± 20%	15678
C-69	Electrolytic 80 -80mf 200v - 200v	15214
C-70	Part of C-69	15214
C-71	Electrolytic 30 - 30 mf 350v	15215
C-72	Part of C-71	15215
	CONTROLS	
R-9	Meter zero control 50K	29136
R-11	Off-on volume control 250 K	29137
R-50	Squelch Control 10K	29129
	COILS	
L-1	RF Choke	24400
L-2	RF Coil slug tumed	24405
L-3	RF Choke	24402
L-4	RF Inductor	24403
L-5	RF Choke	24404
L-6	RF Choke	24409
L-7	AF Choke	24109
L-8	RF Input	24408
L-9	Same as L-2	24405
L-10	IF Trans.	81215
L-11	Same as L-10	81215
L-12	Same as L-10	81215
L-13	Same as L-2 less slug	24405
L-14	Same as L-1	24400
L-15	Hash choke	24406
	DIODES	
CR-1	Diode	1N295A
CR-2	Silicone rectifier	63001
CR-3	Same as CR-2	63001
	CABLES AND CONNECTORS	
J-1	Pin jack (red)	27401
J-2	Pin jack (black)	27402
J-3	RF connector	27425
J-4	Cable-W-Socket 6v-12v	99207
J-5	Cable-W-Socket 117v AC	99208
P-1	10 contact plug	59503
	RESISTORS	
R-1	47K ohms 1/2w 10%	69157
R-2	Same as R-1	69157
R-3	4.7K ohms 1/2w 10%	69145
R-4	22K ohms 1/2w 10%	69153
R-5	Same as R-4	69153
R-6	100 ohms 1/2w 10%	69125
R-7	3.3K ohms 1/2w 10%	69143

MODEL GRS 1566 GENERAL RADIO SERVICE EQUIPMENT

REPLACEABLE PARTS

REF. SYMBOL	DESCRIPTION	PART NO.
	RESISTORS (Cont'd.)	
R-8	33K ohms 1/2w 10%	69155
R-9	See Controls	
R-10	6.8K ohms 1/2w 10%	69147
R-11	See Controls	
R-12	Same as R-6	69125
R-13	10 meg. ohms 1/2w 10%	69185
R-14	1 meg. ohm 1/2w 10%	69173
R-15	330 ohms 1w 10%	69331
R-16	10K ohm 2w 10%	69549
R-17	220K ohm 1/2w 10%	69165
R-18	470K ohm 1/2w 10%	69169
R-19	82K ohm 1/2w 10%	69160
R-20	Same as R-14	69173
R-21	Same as R-14	69173
R-22	Same as R-13	69185
R-22.1	560K ohm 1/2w 10%	69170
R-22.2	Same as R-22.1	69170
R-23	Same as R-14	69173
R-24	330K ohm 1/2w 10%	69167
R-25	Same as R-17	69165
R-26	Same as R-17	69165
R-27	18K ohm 1/2w 10%	69152
R-28	3.9 meg. ohm 1/2w 10%	69180
R-29	100K ohm 1/2w 10%	69161
R-30	Same as R-14	69173
R-31	1.8K ohm 1/2w 10%	69140
R-32	15K ohm 1/2w 10%	69151
R-33	Same as R-29	69161
R-34	Same as R-17	69165
R-35	68 ohm 1/2w 10%	69123
R-36	68K ohm 1/2w 10%	69159
R-37	Same as R-3	69145
R-38	Same as R-17	69165
R-39	10K ohm 1/2w 10%	69149
R-40	68K ohm 1w 10%	69359
R-41	Same as R-3	69145
R-42	Same as R-17	69165
R-43	Same as R-46	69129
R-44	Same as R-36	69159
R-45	Same as R-3	69145
R-46	220 ohm 1/2w 10%	69129
R-47	Same as R-36	69159
R-48	Same as R-3	69145
R-49	Same as R-14	69173
R-50	See Controls	
R-51	Same as R-14	69173
R-52	Same as R-8	69155
R-53	Same as R-1	69157
R-54	39 ohm 2w 10%	69520
R-55	200 ohm 5w 10% wire wound	69718
R-56	Same as R-55	69718
R-57	1 meg ohm 1/2 w 20%	69273
	SWITCHES	
S-1	Part of R-11	29137
S-2A	Band switch	75303
S-2B	Part of S-2A	75303

REF. SYMBOL	DESCRIPTION	PART NO.
	TRANSFORMERS	
T-1	Trans audio output 5500 to 3.2 ohms	80031
T-2	Trans power Primary 117v AC .5 amp 12v DC 4.5 amp 6v DC 10 amp Secondary Output over voltage doubler 270v DC at 100 MA	82101
	ELECTRON TUBES	
V-1A	XMTR osc.	12AV7/2
V-1B	Noise amp.	12AV7/2
V-2	PWR amp	6AQ5
V-3A	Audio driver	12AX7/2
V-3B	Squelch	12AX7/2
V-4	RCVR-audio output XMTR mod	6AQ5
V-5A	Noise rect.	6AL5/2
V-5B	Mixer AVC gate	6AL5/2
V-6A	Noise limiter	6BJ7/3
V-6B	Det	6BJ7/3
V-6C	Squelch rect.	6BJ7/3
V-7	R.F.	6BA6
V-8A	Mixer	6U8/2
V-8B	RCVR osc.	6U8/2
V-9	1st IF	6BA6
V-10	2nd IF	6BA6
	MISCELLANEOUS PARTS	
F-1	6 amp fuse for 12V DC	42112
F-1	15 amp fuse for 6V DC	42113
F-2	1 amp fuse for 117V	42114
K-1	Relay	66002
LS-1	Speaker 3.2 ohm 5" x 3"	73100
M-1	Meter	48001
VIB-1	Vibrator 6 volt	88100

GNISHOLM INDUSTRIES LTD. PORT MOODY, B. C.	DWG. No. 37-1566
PROJECT 1566 GRS PHONE	TITLE SCHEMATIC DIAGRAM
ISSUE BY CANCELLED	DRAWN BY: gwc · CHK'D BY: PW · APP'D BY: Hap
DATE REFERENCE DWGS.	DATE: 4-19-62 · D.D. · SHEET No. 1 OF 1 · REF. FILE No.

DO NOT SCALE THIS DRAWING

V1A 12AV7/2 XMTR OSC.

V2 6AQ5 PWR AMP

V3A 12AX7/2 AUDIO DRIVER

V4 6AQ5 RCVR-AUDIO OUTPUT XMTR MODULATOR

V7 6BA6 RF

V8A 6U8/2 MIXER

V9 6BA6 1ST IF

V5B 6AL5/2 MIXER AVC GATE

V8B 6U8/2 RCVR. OSC.

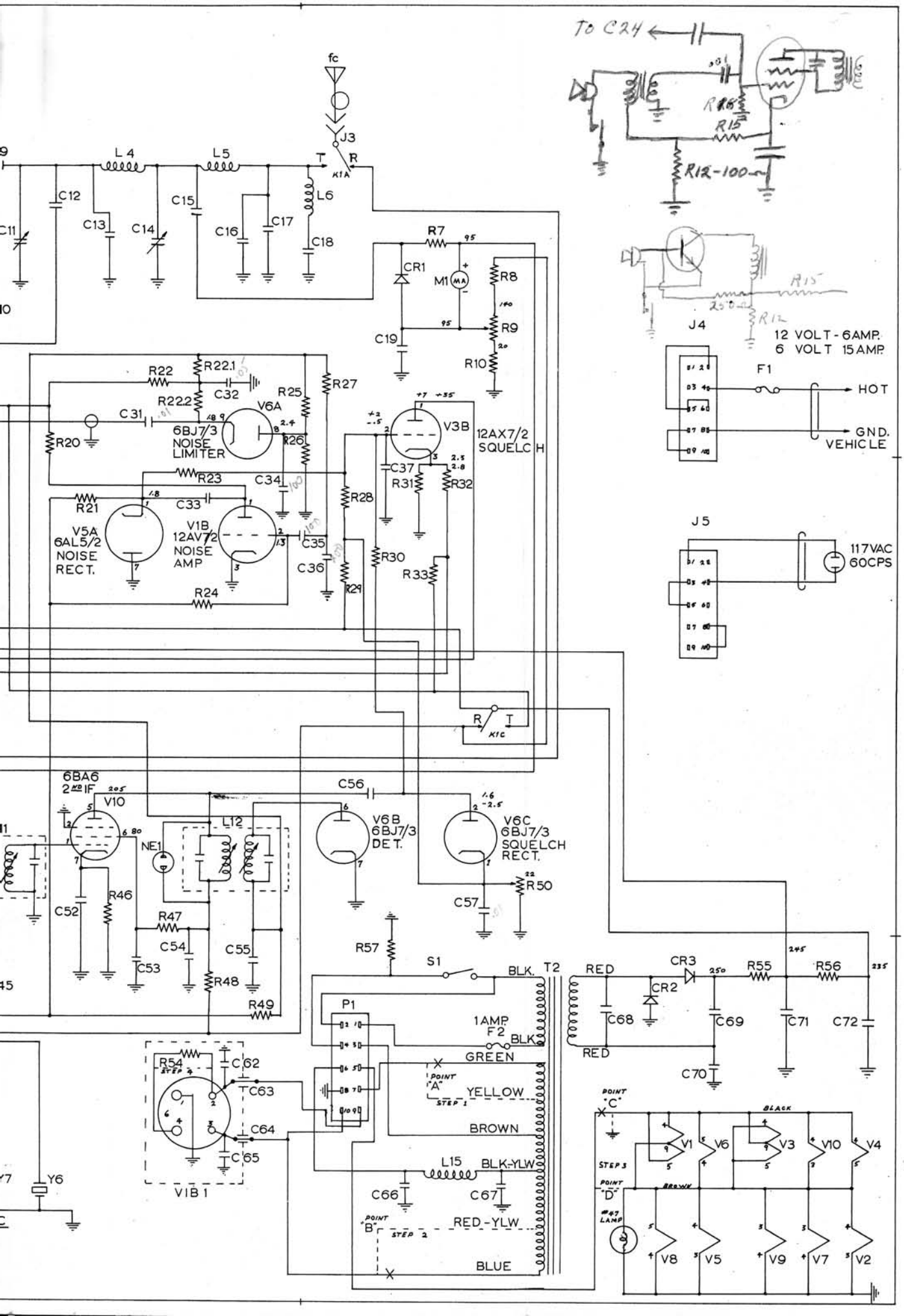
CARBON MIC

PUSH TO TALK

SOCKET CAPACITY

140 C

Hamond.


TO C24
R15
R12-100
J4
12 VOLT - 6AMP.
6 VOLT 15AMP
F1
HOT
GND.
VEHICLE
J5
117VAC
60CPS
fc
J3
T
R
K1A
L4
L5
L6
C11
C12
C13
C14
C15
C16
C17
C18
R7
CR1
M1
R8
R9
R10
C19
R22
R22.1
C32
R22.2
C31
R20
V6A
6BJ7/3
NOISE
LIMITER
R25
R26
R27
V3B
12AX7/2
SQUELCH
C37
R31
R32
R23
C34
R28
R21
C33
V5A
6AL5/2
NOISE
RECT.
V1B
12AV7/2
NOISE
AMP
C35
C36
R29
R30
R33
R24
K1C
6BA6
2ND IF
V10
L12
NE1
C56
V6B
6BJ7/3
DET.
V6C
6BJ7/3
SQUELCH
RECT.
R50
C57
C52
R46
R47
C54
C55
C53
R48
R49
R57
S1
BLK.
T2
P1
1AMP
F2
BLK
GREEN
YELLOW
BROWN
L15
BLK-YLW
RED-YLW
BLUE
RED
CR3
CR2
R55
R56
C68
C69
C71
C72
C70
R54
C62
C63
C64
C65
V1B1
Y6
POINT "A"
POINT "B"
POINT "C"
POINT "D"
STEP 1
STEP 2
STEP 3
#47 LAMP
V1
V6
V3
V10
V4
V8
V5
V9
V7
V2